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(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Robert Pezzani
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For:	HF-CONTROLLED SCR-TYPE SWITCH
Examiner:	L. E. Roman
Art Unit:	2836

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Dated: July 21, 2008 Judy Daley (Signature)

AMENDMENT IN RESPONSE TO FINAL ACTION UNDER 37 C.F.R. 1.116

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

INTRODUCTORY COMMENTS

In response to the Office Action mailed February 20, 2008, please amend the above-identified U.S. patent application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 9 of this paper.

AMENDMENTS TO THE CLAIMS

Applicant submits below a complete listing of the current claims, including marked-up claims with insertions indicated by underlining and deletions indicated by strikeouts and/or double bracketing. This listing of claims replaces all prior versions, and listings, of claims in the application:

Listing of the Claims

1. (Previously Presented) A method for controlling an SCR-type switch, comprising applying to a switch gate of the SCR-type switch several periods of an unrectified high frequency voltage in succession, such that an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch, a power of each halfwave of the several periods being individually insufficient to start the SCR-type switch.

2. (Previously presented) The method of claim 1, wherein the high frequency voltage oscillates at a selected frequency between 10 kHz and a few GHz.

3. (Previously presented) The method of claim 1, wherein the high frequency voltage is applied via an insulating layer formed above a starting area of the component.

4. (Previously presented) The method of claim 3, wherein the high frequency voltage is applied above a gate region of a thyristor.

5. (Previously presented) The method of claim 3, wherein the high frequency voltage is applied above a gate region of a triac.

6. (Previously presented) The method of claim 3, wherein the high frequency voltage is applied via a high-frequency line having terminals for connection to the high frequency voltage.

7. (Previously presented) The method of claim 3, wherein the high frequency voltage is applied via a winding that generates a magnetic field or responds to a magnetic field.

8. (Previously Presented) An SCR-type switch component, comprising two main electrodes and at least one control electrode formed on an insulating layer that insulates the control electrode from a starting region of the component, said control electrode controlling the SCR-type switch component in response to an unrectified high frequency power supply that supplies several periods of an unrectified high frequency voltage in succession, wherein the SCR-type switch component is configured such that the SCR-type switch component is not turned on in response to an individual one of the several periods, wherein the SCR-type component is configured such that an accumulated effect of applying the several periods in succession causes the SCR-type switch to turn on.

9. (Previously presented) The SCR-type switch component of claim 8, wherein the control electrode is arranged above a gate region of a thyristor.

10. (Previously Presented) The SCR-type switch component of claim 8, wherein the control electrode is arranged above a gate region of a triac.

11. (Previously Presented) The SCR-type switch component of claim 8, wherein the control electrode is a high-frequency line having terminals for connection to the high frequency power supply.

12. (Previously Presented) The SCR-type switch component of claim 8, wherein the high frequency is applied via a winding that generates a magnetic field or responds to a magnetic field.

13. (Previously Presented) A method of controlling an SCR-type switch, the method comprising:

providing, to a control terminal of the SCR-type switch, a high-frequency control voltage that controls the SCR-type switch without supplying current from the control terminal to a starting area of the SCR-type switch, wherein the high-frequency control voltage comprises a plurality of halfwaves, wherein the SCR-type switch is turned on in response to an accumulated effect of the plurality of halfwaves, an individual one of the plurality of halfwaves being of insufficient intensity and/or duration to start the switch by itself.

14. (Previously Presented) The method of claim 13, wherein the high frequency voltage oscillates at a frequency that is between 10 kHz and a few GHz.

15. (Previously Presented) The method of claim 13, wherein the high frequency voltage oscillates at a frequency of 1 MHz or higher.

16. (Previously presented) The method of claim 13, wherein the high frequency control voltage is provided to the control terminal through a capacitor.

17. (Previously presented) The method of claim 13, wherein the control terminal is insulated from the starting area.

18. (Previously presented) The method of claim 13, wherein the high-frequency control voltage comprises a plurality of halfwaves, wherein each one of the plurality of halfwaves is individually insufficient to turn on the SCR-type switch.

19. (Previously presented) The method of claim 18, wherein a power of each one of the plurality of halfwaves is individually insufficient to turn on the SCR-type switch.

20. (Previously presented) The method of claim 18, wherein a voltage of each one of the plurality of halfwaves is individually insufficient to turn on the SCR-type switch.

21. (Previously presented) The method of claim 18, wherein a duration of each one of the plurality of halfwaves is individually insufficient to turn on the SCR-type switch.

22. (Canceled)

23. (Previously presented) The method of claim 13, wherein the high-frequency control voltage is unrectified.

24. (Previously presented) The method of claim 13, wherein the high-frequency control voltage is applied via a winding that generates a magnetic field or responds to a magnetic field.

25. (Previously Presented) A method of controlling an SCR-type switch, the method comprising:

providing a high frequency control signal to a gate of the SCR-type switch that controls the SCR-type switch, the high frequency control signal having a frequency of 1 MHz or higher, wherein a duration of a single halfwave of the high frequency control signal is insufficient for the single halfwave to turn on the SCR-type switch;

wherein the control signal is provided to the gate through a capacitor.

26. (Previously Presented) An method of controlling an SCR-type switch, the method comprising:

providing a high-frequency control voltage to a gate of the SCR-type switch that controls the SCR-type switch;

wherein the SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves of the high-frequency control voltage but is not turned on in response to an effect of an individual one of the plurality of halfwaves.

27. (Previously Presented) An SCR-type switch, comprising:

a starting region;

an insulating region; and

a first control electrode that is insulated from the starting region by the insulating region; wherein the SCR-type switch is controlled by applying a high-frequency control voltage to the control electrode;

wherein the SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves of the high-frequency control voltage.

28. (Previously presented) The SCR-type switch of claim 27, wherein the first control electrode is completely insulated from the starting region.

29. (Previously presented) The SCR-type switch of claim 27, wherein the first control electrode is inductively coupled to the starting region via the insulating region.

30. (Previously presented) The SCR-type switch of claim 27, wherein the first control electrode is capacitively coupled to the starting region via the insulating region.

31. (Previously presented) The SCR-type switch of claim 30, wherein the first control electrode contacts the insulating region.

32. (Previously presented) The SCR-type switch of claim 31, wherein the insulating region contacts the starting region.

33. (Previously presented) The SCR-type switch of claim 27, wherein the first control electrode is insulated, via the insulating layer, from a semiconductor substrate in which semiconductor layers of the SCR-type switch component are formed.

34. (Previously presented) The SCR-type switch of claim 27, further comprising:

a second control electrode that is insulated from the starting region by the insulating region.

35. (Previously presented) The SCR-type switch of claim 34, wherein the starting region comprises a first region of a first conductivity type and a second region of a second conductivity type, wherein the first control electrode is closer to the first region than to the second region, and wherein the second control electrode is closer to the second region than to the first region.

36. (Previously presented) The SCR-type switch of claim 27, wherein the first control electrode contacts the insulating region.

37. (Previously presented) The SCR-type switch of claim 27, wherein the insulating region contacts the starting region.

38. (Previously presented) The SCR-type switch of claim 27, wherein the SCR-type switch is a triac.

39. (Previously presented) The SCR-type switch of claim 27, wherein the SCR-type switch is a thyristor.

40. (Canceled)

41. (Previously Presented) The SCR-type switch of claim 27, wherein the effect of the plurality of halfwaves of the high-frequency control voltage being applied to the control electrode close enough in time and large enough in intensity such that the accumulated effect of the plurality of halfwaves gradually increases over time and thereby turns on the SCR-type switch, wherein the SCR-type switch is not turned on in response to an effect of an individual one of the plurality of halfwaves applied by itself.

42. (Currently Amended) The SCR-type switch of claim 27 [[40]], wherein the high-frequency control voltage oscillates at a frequency of 1 MHz or higher.

43. (Currently Amended) The SCR-type switch of claim 27 [[40]], wherein the high-frequency control voltage controls the SCR-type switch without supplying current from the control terminal to the starting area.

44. (Previously presented) The method of claim 25, wherein providing, to the gate of the SCR-type switch, a plurality of halfwaves of the high frequency voltage in succession turns on the SCR-type switch.

45. (Previously presented) The method of claim 44, wherein providing the plurality of halfwaves of the high frequency voltage in succession creates an accumulated effect at a starting area of the SCR-type switch that is sufficient to turn on the SCR-type switch.

REMARKS

In response to the Office Action mailed February 20, 2008, Applicant respectfully requests reconsideration. Claims 1-21, 23-39 and 41-45 were previously pending in this application. Claims 42 and 43 have been amended herein to correct their dependency. No claims have been added or canceled herein. As a result, claims 1-21, 23-39 and 41-45 remain pending for examination with claims 1, 8, 13, 25, 26, and 27 being independent. No new matter has been added.

Objections to the Claims

The Office Action objected to claims 42 and 43 because they depended on canceled claim 40. In response, claims 42 and 43 have been amended to depend from independent claim 27. Accordingly, withdrawal of these objections is respectfully requested.

Rejections Under 35 U.S.C. §102

The Office Action rejected independent claims 1 and 26 under 35 U.S.C. §102(b) as purportedly being anticipated by Shinoda (4,779,036). Applicant respectfully traverses these rejections.

1. Shinoda does not teach or suggest that an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch.

The Office Action relies on Shinoda as purportedly describing "applying to a switch gate of the SCR-type switch several periods of an unrectified high frequency voltage in succession, such that an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch." Applicant respectfully disagrees. Shinoda makes no mention of an accumulated effect created by applying several periods in succession, much less that an accumulated effect starts the switch. Contrary to the Office Action's rationale, Shinoda's switch does not turn on in response to an accumulated effect. Rather, Shinoda states that a single pulse turns on Shinoda's switch. (Col. 5, lines 53-56). Shinoda only applies several pulses in case one

pulse fails to turn the switch on, due to poor environmental conditions. (Col. 5, lines 64-66). Thus, Shinoda's pulses are redundant and produce no accumulated effect.

The Office Action states that the "accumulated effect" recited in claims 1 and 26 is an inherent characteristic of Shinoda's switch because an SCR-type switch inherently comprises parasitic capacitances. Applicant respectfully disagrees with the Office Action's rationale because claims 1 and 26 do not recite "parasitic capacitances." Rather, claim 1, for example, recites "an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch." The Office Action has provided no rationale as to how the presence of parasitic capacitances implies the creation of an accumulated effect by applying the several periods in succession. Thus, the Office Action fails to meet the standard for inherency. These rejections are further improper because Shinoda makes no mention that an accumulated effect causes the SCR-type switch to start. Notably, the Office Action has provided no rationale as to how Shinoda's device starts due to an accumulated effect, as opposed to being turned on in some other way. Contrary to the Office Action's rationale, a single pulse turns on Shinoda's device, not a combination of pulses. Shinoda makes no mention of one pulse contributing to the effectiveness of another pulse. Instead, one of Shinoda's pulses is effective as long as poor environmental conditions are not present. (Col. 5, lines 64-66).

In addition to being legally insufficient, the Office Action's rationale is incorrect from a technical perspective because the mere presence of parasitic capacitances does not imply the creation of an accumulated effect in Shinoda's switch, much less an accumulated effect that turns on the switch. Shinoda is silent as to the size of any such parasitic capacitances, and makes no mention that such an accumulated effect would be created as a result of Shinoda's pulse timing. One of ordinary skill in the art would appreciate that such an accumulated effect is not inherently present in Shinoda's device.

Applicant's specification provides further evidence that such an accumulated effect is not necessarily present as a result of applied pulses and parasitic capacitances in a switch. The specification states:

> A priori, when an A.C. signal is applied to the gate of a thyristor such that the power of each halfwave is insufficient to turn on the thyristor and that the duration of each halfwave is shorter than the component priming time, the effect

of positive and negative halfwaves annuls and the A.C. signal has no switch starting effect. (Page 3, line 31 – Page 4, line 3)

Thus, as described in Applicant's specification, there are some situations in which applying several halfwaves of insufficient power <u>does not turn on the switch</u>. For example, when the duration of each halfwave is shorter than the component priming time, the effect of positive and negative halfwaves cancels out and the switch does not turn on. Thus, an accumulated effect is not necessarily generated, much less an accumulated effect that can turn on the switch.

For these reasons, Shinoda does not teach or suggest that "an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch," either expressly or inherently.

2. <u>Shinoda fails to teach or suggest that a power of each halfwave of the several periods is individually insufficient to start the SCR-type switch.</u>

The Office Action relies upon Shinoda's pulses as purportedly being such that "the power of each halfwave of the several periods is individually insufficient to start the switch." Applicants respectfully disagree. As explained by Shinoda, each halfwave of Shinoda's pulses is sufficient to turn on the switch. (Col. 5, line 53 – Col. 6, line 2). The fact that Shinoda applies several redundant pulses of sufficient power fails to meet the claim limitations. Notably, Shinoda does not describe a single halfwave having insufficient power to turn on the switch, much less that the power of <u>each</u> halfwave is individually insufficient. Indeed, in Shinoda's device no accumulated effect is necessary because any one of Shinoda's pulses can turn on the switch by itself.

<u>Claim 1</u>

By contrast, claim 1 recites, *inter alia*, applying to a switch gate of the SCR-type switch several periods of an unrectified high frequency voltage in succession, such that an accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch, a power of each halfwave of the several periods being individually insufficient to start the SCR-type switch. As should be appreciated from the above discussion, Shinoda does not teach or suggest that an

accumulated effect on the SCR-type switch of applying the several periods in succession is to start the SCR-type switch. In addition, Shinoda does not teach or suggest that a power of each halfwave of the several periods is individually insufficient to start the SCR-type switch. In view of the foregoing, claim 1 patentably distinguishes over Shinoda. Accordingly, withdrawal of these rejections is respectfully requested.

Claims 2-7 depend from claim 1 and are therefore patentable for at least the same reasons.

Claim 26

Claim 26 recites, *inter alia*, that an SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves of the high-frequency control voltage but is not turned on in response to an effect of an individual one of the plurality of halfwaves. As should be appreciated from the above discussion, Shinoda does not teach or suggest that an SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves. In view of the foregoing, claim 26 patentably distinguishes over Shinoda. Accordingly, withdrawal of these rejections is respectfully requested.

Rejections Under 35 U.S.C. §103

The Office Action rejected independent claims 8 and 13 under 35 U.S.C. §103(a) as purportedly being unpatentable over Shinoda in view of Iwamuro et al. (6,091,087). The Office Action also rejected independent claim 25 under 35 U.S.C. §103(a) as purportedly being unpatentable over Shinoda in view of Nuckolls (3,344,310). In addition, the Office Action rejected independent claim 27 under 35 U.S.C. §103(a) as purportedly being unpatentable over Shinoda in view of Bhagat (4,630,092). Applicant respectfully traverses these rejections.

Claim 8

Claim 8 recites, *inter alia*, an SCR-type component that is configured such that an accumulated effect of applying the several periods in succession causes the SCR-type switch to turn on. As should be appreciated from the above discussion, Shinoda does not teach or suggest an SCR-type component that is configured such that an accumulated

effect of applying the several periods in succession causes the SCR-type switch to turn on. Iwamuro fails to remedy this deficiency of Shinoda. Therefore, claim 8 patentably distinguishes over any combination of Shinoda and Iwamuro. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 9-12 depend from claim 8 and are therefore patentable for at least the same reasons.

Claim 13

Claim 13 recites, *inter alia*, that the SCR-type switch is turned on in response to an accumulated effect of the plurality of halfwaves, an individual one of the plurality of halfwaves being of insufficient intensity and/or duration to start the switch by itself. As should be appreciated from the above discussion, Shinoda does not teach or suggest that an SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves. Iwamuro fails to remedy this deficiency of Shinoda. Therefore, claim 13 patentably distinguishes over any combination of Shinoda and Iwamuro. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 14-21, 23 and 24 depend from claim 13 and are therefore patentable for at least the same reasons.

Claim 25

Claim 25 recites, *inter alia*, providing a high frequency control signal to a gate of the SCR-type switch that controls the SCR-type switch, the high frequency control signal having a frequency of 1 MHz or higher, wherein a duration of a single halfwave of the high frequency control signal is insufficient for the single halfwave to turn on the SCR-type switch. The Office Action concedes (page 9) that the combination of Shinoda and Nuckolls fails to teach or suggest providing a high frequency control signal having a frequency of 1 MHz or higher. However, the Office action contends that it would have been obvious to use a control signal having a frequency of 1 MHz or higher because, where the general conditions of a claim are disclosed in the prior art, discovering optimum or workable ranges involves only routine skill the art. Applicant respectfully disagrees.

The frequency 1 MHz is not the same "general condition" as Shinoda's frequency of 20 kHz because 1 MHz is fifty times greater than 20 kHz. One of ordinary skill in the art would not have increased Shinoda's operating frequency by a factor of fifty solely based on a desire to perform routine optimization. It is unclear whether Shinoda's drive circuitry even would have been capable of supplying pulses at a frequency of 1 MHz. The present case is quite unlike In Re Aller (cited by the Office Action, decided in 1955) in which a claimed temperature range of 40°C - 80°C did not patentably distinguish over a prior art temperature of 100°C. In Aller, the claimed range and prior art differed by a factor of only 1.25, however, in the present case the claimed frequency range differs from the prior art frequency by a factor of fifty. In view of the foregoing, the claimed frequency of greater than 1 MHz is not an obvious variation in view of the prior art.

Even if this rejection were proper (which it is not), MPEP 2144.05 states that the Applicant can rebut a *prima facie* case of obviousness by showing new and unexpected results with respect to the prior art. In fact, the present specification describes how the claimed invention provided a new and unexpected result. The specification states:

> A priori, when an A.C. signal is applied to the gate of a thyristor such that the power of each halfwave is insufficient to turn on the thyristor and that the duration of each halfwave is shorter than the component priming time, the effect of positive and negative halfwaves annuls and the A.C. signal has no switch starting effect.
>
> The applicant has however tried the experiment in a diagram of the type in Fig. 1, in which an HF signal is applied between gate G and cathode A of a thyristor. A D.C voltage VAK of appropriate biasing is applied across the series assembly of a load L and of thyristor TH. It is considered that cathode K of the thyristor is grounded.
>
> In Fig. 2, an HF voltage at a frequency of approximately 1 megahertz applied between the gate and the cathode has been shown by a curve 10 and the observed anode current has been shown by a curve 11. It should be noted that, after approximately three halfwaves of the high-frequency A.C. voltage, the thyristor conduction settles. Then, as conventional with a thyristor, the HF power supply can be interrupted and the thyristor remains conductive. (Page 3, line 31 – Page 4, line 13).
>
> [...]
>
> Thus, unexpectedly, when a high-frequency control voltage is applied to the gate of a thyristor, and more generally of an SCR-type switch, said switch is switched on while each halfwave of the A.C. voltage has a power and/or a duration insufficient to ensure the switching of the

considered SCR-type component. (Page 4, lines 20-23).

As described in the above portion of the specification, the Applicant appreciated that applying several halfwaves of suitable frequency can turn on a thyristor, even if each halfwave is individually insufficient to turn on the switch. This unexpected result is quite unlike Shinoda's technique of applying redundant pulses in case one pulse fails. In view of the foregoing, claim 25 patentably distinguishes over any combination of Shinoda and Nuckolls. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 44 and 45 depend from claim 25 and are therefore patentable for at least the same reasons.

Claim 27

Claim 27 recites, *inter alia*, that the SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves of the high-frequency control voltage. As should be appreciated from the above discussion, Shinoda does not teach or suggest that an SCR-type switch is turned on in response to an accumulated effect of a plurality of halfwaves of the high-frequency control voltage. Bhagat fails to remedy this deficiency of Shinoda. Therefore, claim 27 patentably distinguishes over any combination of Shinoda and Bhagat. Accordingly, withdrawal of this rejection is respectfully requested.

Claims 28-39 and 41-43 depend from claim 27 and are therefore patentable for at least the same reasons.

CONCLUSION

In view of the foregoing, the present application is believed to be in condition for allowance. A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Dated: July 21, 2008

Respectfully submitted,

By: Robert A Jensen

Robert A. Jensen, No. 61,146
Wolf, Greenfield & Sacks, P.C.
Federal Reserve Plaza
600 Atlantic Avenue
Boston, Massachusetts 02210-2206
Telephone: (617) 646-8000